JUL 1987

Y3.N88:25/4950/V/1

NUREG/CR-4950
Vol. 1

ORIGINAL

The Shoreline Environment Atmospheric Dispersion Experiment (SEADEX)

Experiment Description

Prepared by B. K. Cantrell, W. B. Johnson, B. M. Morley,
E. E. Uthe, K. C. Nitz

SRI International

Prepared for
U.S. Nuclear Regulatory
Commission

CD

NOTICE

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, or any of their employees, makes any warranty, expressed or implied, or assumes any legal liability of responsibility for any third party's use, or the results of such use, of any information, apparatus, product or process disclosed in this report, or represents that its use by such third party would not infringe privately owned rights.

NOTICE

Availability of Reference Materials Cited in NRC Publications

Most documents cited in NRC publications will be available from one of the following sources:

1. The NRC Public Document Room, 1717 H Street, N.W.
   Washington, DC 20555
2. The Superintendent of Documents, U.S. Government Printing Office, Post Office Box 37082,
   Washington, DC 20013-7082
3. The National Technical Information Service, Springfield, VA 22161

Although the listing that follows represents the majority of documents cited in NRC publications, it is not intended to be exhaustive.

Referenced documents available for inspection and copying for a fee from the NRC Public Document Room include NRC correspondence and internal NRC memoranda; NRC Office of Inspection and Enforcement bulletins, circulars, information notices, inspection and investigation notices; Licensee Event Reports; vendor reports and correspondence; Commission papers; and applicant and licensee documents and correspondence.

The following documents in the NUREG series are available for purchase from the GPO Sales Program: formal NRC staff and contractor reports, NRC sponsored conference proceedings, and NRC booklets and brochures. Also available are Regulatory Guides, NRC regulations in the *Code of Federal Regulations*, and *Nuclear Regulatory Commission Issuances*.

Documents available from the National Technical Information Service include NUREG-series reports and technical reports prepared by other federal agencies and reports prepared by the Atomic Energy Commission, forerunner agency to the Nuclear Regulatory Commission.

Documents available from public and special technical libraries include all open literature items, such as books, journal and periodical articles, and transactions. *Federal Register* notices, federal and state legislation, and congressional reports can usually be obtained from these libraries.

Documents such as theses, dissertations, foreign reports and translations, and non-NRC conference proceedings are available for purchase from the organization sponsoring the publication cited.

Single copies of NRC draft reports are available free, to the extent of supply, upon written request to the Division of Information Support Services, Distribution Section, U.S. Nuclear Regulatory Commission, Washington, DC 20555.

Copies of industry codes and standards used in a substantive manner in the NRC regulatory process are maintained at the NRC Library, 7920 Norfolk Avenue, Bethesda, Maryland, and are available there for reference use by the public. Codes and standards are usually copyrighted and may be purchased from the originating organization or, if they are American National Standards, from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

NUREG/CR-4950
Vol. 1

The Shoreline Environment Atmospheric Dispersion Experiment (SEADEX)

Experiment Description

Manuscript Completed: March 1987
Date Published: June 1987

Prepared by
B. K. Cantrell*, W. B. Johnson**, B. M. Morley,
E. E. Uthe, K. C. Nitz

SRI International
333 Ravenswood Avenue
Menlo Park, CA 94025

* Presently with Minneapolis Research Center
** Presently with National Center for Atmospheric Research

Prepared for
Division of Engineering
Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission
Washington, DC 20555
NRC FIN B6793

BEST COPY AVAILABLE

BLANK PAGE

ABSTRACT

The SEADEX atmospheric dispersion field study was conducted during the period May-June 8, 1982, in northeastern Wisconsin, in the vicinity of the Kewaunee Power Plant on the western shore of Lake Michigan. The specific objectives of SEADEX were to characterize (1) the atmospheric dispersion and (2) the meteorological conditions influencing this dispersion as completely as possible during the test period. This field study included a series of controlled tracer tests utilizing state-of-the-art tracer measurement technology to determine horizontal and vertical dispersion over both land and water. Extensive meteorological measurements were obtained to thoroughly characterize the three-dimensional structure of the atmospheric boundry layer controlling the dispersion process. This volume describes the experimental design for, and conduct of, the study.

BEST AVAILABLE

BLANK PAGE

CONTENTS

ACKNOWLEDGEMENTS vii

I OBJECTIVES OF SEADEX 1

II ORGANIZATION OF SEADEX-I 3

III SITE DESCRIPTION 4

A. Geography 4
B. Wind Climatology 4

IV FIELD TEST DESIGN 9

A. Field Test Elements and Design Parameters 9
B. Instrumentation Deployment 12

V SUMMARY OF TRACER TESTS CONDUCTED 15

VI LOGISTICS AND OPERATIONS 17

A. Logistics 17
B. Operations 18

VII DATA REDUCTION, ANALYSIS, AND REPORTING 20

APPENDIX 21

BEST COPY AVAILABLE

BLANK PAGE

ACKNOWLEDGEMENTS

The planning and execution of the complex SEADEX-I field program involved the intensive efforts of a large number of very dedicated individuals. Although we cannot name all of these persons here, we do wish to express our sincere gratitude for their assistance.

The contributions of the following individuals from the institutions indicated were particularly vital to the success of the program:

U.S. Nuclear Regulatory Commission (NRC):

- Robert Kornasiewicz
- Robert Abbey*
- Barry Zalcman
- Irvin Spickler
- Leta Brown

National Oceanic and Atmospheric Administration (NOAA):

- Ray Dickson
- Gene Start
- Gene White
- Isaac VanderHoven*
- Brent Nelson
- Cliff Spencer
- John Cate
- Bob Heard
- Rick Poole
- Perry Hardin
- LaMar Olsen
- Lydia Thorngren

Argonne National Laboratory (ANL):

- Richard Coulter
- Marvin Wesely

Aeronautical Research Associates of Princeton, Inc. (ARAP):

- Steve Lewellen

*Institutional affiliation is now different from that indicated.

BEST COPY AVAILABLE

Wisconsin Public Service Corp.

- Tom Meinz
- Gary Van Helvoirt
- Kathy Flanigan

Mesomet, Inc.:

- Walter Lyons

The Research Corporation of New England, Inc. (TRC):

- Donald Shearer*

Colorado State University:

- Robert Meroney

Oak Ridge National Laboratory:

- Frank Kornegay

SRI International (SRI):

- Norman Nielsen
- Chuck Flohr
- William Dyer
- Richard Brodzinsky*
- Tom Freitas*
- William Hovelman*
- William Viezee
- Barbara Camph

Finally, we thank Valerie Ramsay and Dorothy Sevela of SRI, and Connie Hamilton and Peggy Taylor of the National Center for Atmospheric Research, for their help in preparing this report.

*Institutional affiliation is now different from that indicated.

BEST COPY

I OBJECTIVES OF SEADEX

The SEADEX* program was initiated by the U.S. Nuclear Regulatory Commission (NRC) for the primary purpose of acquiring a high-quality data base for use in evaluating existing and proposed models of dispersion during postulated accident conditions at nuclear power plants within coastal zones. The evaluated models can then be used both for emergency planning as well as for site-characterization purposes. A secondary objective of SEADEX is to provide data to determine what meteorological measurements are necessary at nuclear power plants for adequate emergency preparedness.

This document presents the experiment description for SEADEX-I, the first field study in this program. SEADEX-I was conducted during the period 28 May - 8 June 1982 in northeastern Wisconsin, in the vicinity of Kewaunee Power Plant on the western shore of Lake Michigan.

The specific objectives of SEADEX-I were to characterize (1) the atmospheric dispersion, and (2) the meteorological conditions influencing this dispersion, as completely as possible during the test period. Accordingly, the field study included a series of controlled tracer tests utilizing state-of-the-art tracer measurement technology to determine the horizontal and vertical dispersion of the tracer plume, over water as well as land. In addition, extensive meteorological measurements were obtained to thoroughly characterize the three-dimensional structure of the atmospheric boundary layer controlling the dispersion processes.

*Shoreline Environment Atmospheric Dispersion Experiment

This is the first of three volumes reporting on the results of SRI International's work during SEADEX-I. The other two volumes are as follows:

- Volume 2 -- Meteorological and Gas Tracer Data
- Volume 3 -- Airborne Lidar Data

Additional reports are being published by other organizations participating in the field program on the results of their measurements.

BEST COPY AVAILABLE

II ORGANIZATION OF SEADEX-I

The NRC established the following organization for the SEADEX-I program:

Project Director: Robert A. Kornasiewicz
U.S. NRC

Field Director: Warren B. Johnson
SRI International

Task Leaders of organizations participating in the field program:

C. Ray Dickson
Gene E. Start
NOAA/Air Resources Lab--Idaho

Edward E. Uthe
SRI International

Richard Coulter
Argonne National Laboratory (ANL)

Walter A. Lyons
Mesomet, Inc.

Other NRC Contractors for related modeling and analysis work:

W. Steven Lewellen
Aeronautical Research Associates of Princeton

Donald L. Shearer
TRC Environmental Consultants

Robert N. Meroney
Colorado State University

The responsibilities of each of the organizations participating in the field study are described in a later section.

III SITE DESCRIPTION

A. Geography

As shown in Figure 1, the field site for SEADEX-I is located in northeastern Wisconsin, approximately 26 miles SE of Green Bay, and 18 miles NNE of Manitowoc. The peninsula of Door County, Wisconsin lies to the north of the field site. This peninsula extends in a generally NE-SW direction and is approximately 20 miles (32 km) wide at the south, tapering to 10 miles (16 km) wide about 40 miles (64 km) NE of the field site.

For logistical reasons, the Field Headquarters for the study was established near the Kewaunee Power Plant, located on the shoreline of Lake Michigan. This site served as the release point for tracer gas, oil fog, and tetroons, and as the location for a number of meteorological measurements.

The land within the field study area, defined as within 10 miles (16 km) of the tracer release point, is mostly flat to gently rolling. The highest elevation in the area is approximately 900 ft (274 m), which is 320 ft (100 m) above the mean water level of Lake Michigan. Since the land in this area is primarily used for dairy farming, it consists mostly of pasture or cropland, with occasional small stands of trees. An extensive road network along section lines is available to facilitate field operations. The shoreline is generally characterized by a low bluff between 20 and 30 ft (6 and 9 m) in height.

B. Wind Climatology

Because wind direction is a critical parameter in the conduct of tracer tests, an extensive study of the wind climatology for two weather stations nearest the field study site was accomplished. The

BEST COPY AVAILABLE

FIGURE 1 LOCATION OF FIELD STUDY AREA

BEST COPY AVAILABLE

nearest routine wind measurements are made at the Manitowoc Airport, three miles inland from the lake, and at the Sheboygan Coast Guard Station, which is located at the lakeshore. Three years of data for the months of May, June, July, and August were processed to produce wind roses as a function of time of day for each month. Those for the month of June (the closest month to the scheduled field study period) are presented in the Appendix.

The times covered by the wind roses for the two stations are not identical. This is because the Manitowoc data were available as hourly measurements from 0500 to 2000 LST, while those from Sheboygan were available only every other hour, but extended over a 24-hr period each day. However, despite these time differences, the Manitowoc and Sheboygan wind roses indicate that S to SE winds are the most frequent during daytime at both stations.

To aid in the interpretation of these data for this study, two on-shore wind direction sectors were established. The shoreline at Manitowoc and Sheboygan (and Kewaunee) runs generally in a direction that is within 10° of a N-S orientation. Accordingly, a preferred, or "primary", sector for on-shore wind direction for the tracer tests was defined as winds coming from the NE-SE quadrant. A tolerable, or "secondary", sector was defined as encompassing winds coming from NNE to SSE. In other words, for tracer sampling purposes, winds from the NE-SE (primary) sector are ideal; however, winds from a wider NNE-SSE (secondary) sector can be expected to give adequate sampling results. In assigning wind direction data to the primary and secondary sectors, these sectors have been considered to have angular widths of 112.5° and 157.5°, respectively, as indicated in Table 1.

BEST COPY AVAILABLE

Table 1

ANGULAR WIDTHS OF WIND DIRECTION SECTORS

Sector	Nominal Wind Direction Coverage	Angular Width*
Primary	NE-SE	$90^{o} + 2\ (11.25^{o}) = 112.5^{o}$
Secondary	NNE-SSE	$135^{o} + 2\ (11.25^{o}) = 157.5^{o}$

*Angular width of wind direction sector used in preparing wind frequency tabulations.

Table 2 summarizes the results of the wind frequency analyses for the month of June. For the daytime hours, wind frequencies for the secondary sector are approximately 40 percent at Manitowoc and 60 percent at Sheboygan. The difference in frequencies is probably due to the differences in station siting.

Based on these climatological data, the SEADEX-I experiment schedule called for a total of 10 tracer tests during a two-week field measurements period. Although this goal was optimistic, it was very nearly achieved during the test program, as described later in this report.

BEST COPY AVAILABLE

Table 2

ONSHORE WIND FREQUENCIES (%)
FOR THE MONTH OF JUNE

Station	Time (CST)	Primary Sector (112.5°)	Secondary Sector (157.5°)
Manitowoc	05-08	13.6	22.3
	09-12	23.1	37.8
	13-16	31.1	43.4
	17-20	20.4	28.4
	05-20	22.1	33.0
Sheboygan	02-04	20.7	38.0
	06-08	21.3	43.2
	10-12	32.3	58.4
	14-16	27.6	56.9
	18-20	24.4	47.2
	22-00	25.2	48.6
	00-22	25.3	48.7

BEST COPY AVAILABLE

IV FIELD TEST DESIGN

A. Field Test Elements and Design Parameters

As mentioned earlier, the two major objectives of the measurement program were:

- Atmospheric dispersion characterization, and
- Meteorology characterization.

For the purpose of dispersion characterization, both a gas tracer (SF_6) and a particulate tracer (oil fog) were used. SF_6 concentrations near the surface were obtained primarily by an array of 130 multiple-bag air samplers. The spacing of these samplers increased with increasing distance from the tracer release point. In addition, a Brookhaven National Laboratory (BNL) Continuous Operating Perfluorocarbon Sniffer (COPS) was used by SRI on a Cessna 337 meteorological aircraft to obtain real-time SF_6 concentration measurements above the surface.

Oil-fog measurements were made by the downlooking ALPHA-1 (Airborne Lidar Plume and Haze Analyzer) system mounted in the SRI International Queen Air aircraft. This system made cross-wind traverses of the tracer plume at two or more downwind distances to map the oil-fog concentration in the x-y plane for later use in calculating horizontal and vertical dispersion. In addition, the SRI Mark-9 ground-mobile lidar system was used to map the oil-fog plume and boundary-layer aerosol structure along selected roadways. This combination of downward-looking ALPHA-1 and upward-looking Mark-9 lidar measurements gave good plume and haze-layer data even during periods of moderate cloud cover.

BEST COPY AVAILABLE

For meteorology (boundary-layer) characterization, the field-test design incorporated measurements of the following parameters:

- Surface winds (13 locations)
- Near-surface wind and temperature profiles (2 locations)
- Boundary-layer wind, temperature, dewpoint and turbulence (5 locations)
- Mixing depths (2 locations)
- Air trajectories (constant-level tetroons)
- Solar and net radiation (1 location)
- Land and water surface temperatures (along-wind horizontal profiles from aircraft radiometer, plus direct measurements from boat).

Details of the experiment design are summarized more completely in Table 3.

BEST COPY AVAILABLE

Table 3

SEADEX-I DESIGN PARAMETERS

Element/Activity	No. Units/Rate/Frequency	Organization
Number of tests	10 (design goal)	--
Test duration	5 hr nominal/2 hr minimum	--
Field direction	---	SRI
Weather forecasting	Facsimile plus teletype	SRI
Gas tracer release and analysis	70 lb/hr, 5 hr/test, 8 GC units	NOAA
Fixed tracer sampling	130 samplers plus spares	NOAA
Mobile tracer sampling	C-337 airplane with BNL continuous SF_6 analyzer	SRI
Oil-fog tracer release	60 gal/hr, 4 hr/test	SRI
Airborne lidar	ALPHA-1, 4 hr/test	SRI
Ground-mobile lidar	Mark 9, 4 hr/test	SRI
Surface wind field	11 (V,θ) on 10-m towers	NOAA
Near-surface wind and temperature profiles	2 (V,θ) + ΔT on 91-m tower 2 (V,θ) + ΔT on 72-m tower	NOAA SRI
BL* wind and temperature profiles	Rabals (two/hr) plus rawinsondes (one/3 hr)	NOAA
Air trajectories	Radar-tracked tetroons (one/hr, 6 hr/test)	NOAA
BL vertical profiles	C-337 aircraft (T, DP, turb.)	SRI
BL wind/temperature profiles over land	Doppler acoustic sounder (continuous 10-min averages) Kytoon (2 profiles/hr)	ANL ANL
BL wind/temperature profiles over lake	Kytoon on R/V EKOS (2 profiles/hr)	ANL
Surface wind and lake water temperatures	From R/V EKOS (2/hr)	ANL

*BL = boundary layer

BEST COPY AVAILABLE

Table 3 (continued)

Element/Activity	No. Units/Rate/Frequency	Organization
Solar and net radiation	Continuous	SRI
Satellite meteorological data	Visible plus IR (2/hr)	Mesomet
NWS meteorological data	Daily	Mesomet
Time-lapse photos of oil-fog release	Two cameras (4 hr/test)	SRI
Radio communications	Three radio systems	SRI and NOAA

B. Instrumentation Deployment

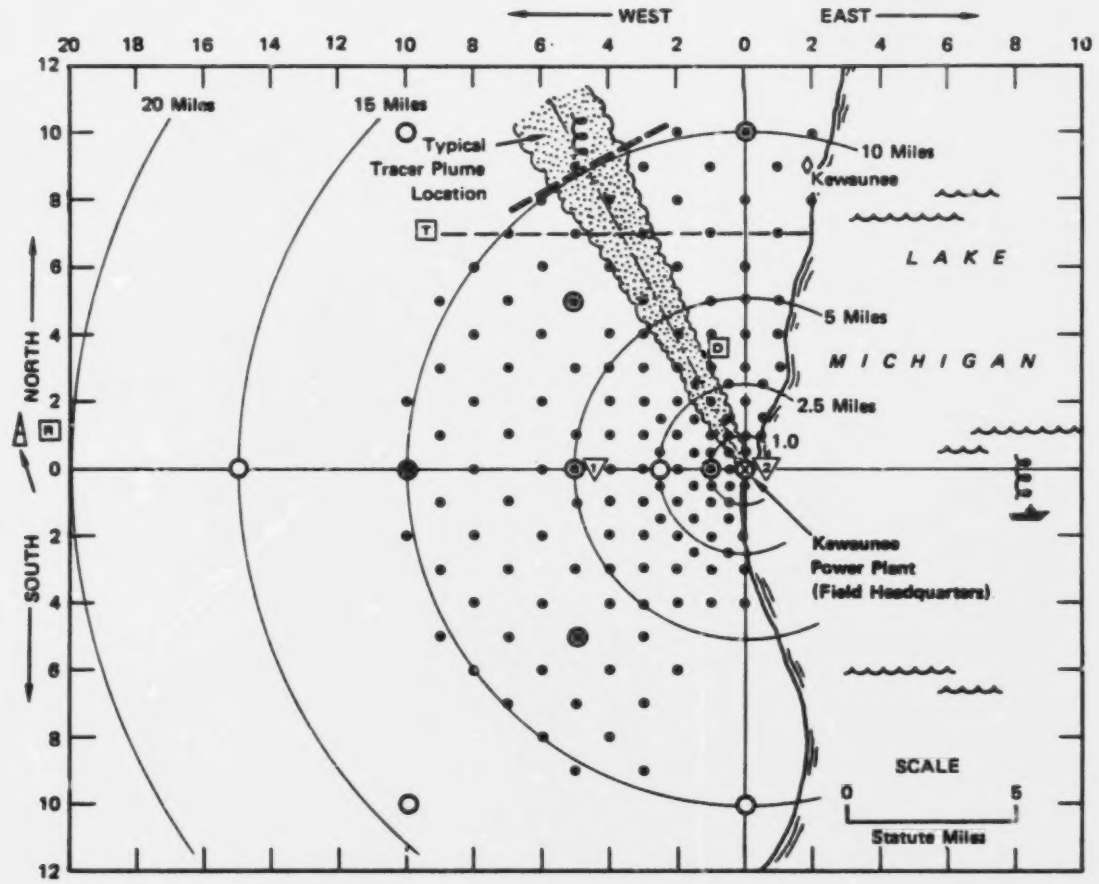
Figure 2 illustrates the deployment of the various instrumentation systems and measurement platforms. The fixed air-sampler array was confined to the area of primary interest for this field test, which is the area within 10 miles (16 km) of the tracer release point. However, extensive meteorological measurements were obtained well beyond this area to aid in the determination of horizontal variations of the meteorological variables across the primary test area. In addition, tetroon tracking and air-trajectory determination extended out to distances of 30 to 40 miles (48 to 64 km) from the release point.

The existing 72-m tower at the Kewaunee Power Plant was used for two purposes. The tracer gas and oil fog were released from the same point on the tower, at an elevation of 41 m. In addition, the tower was instrumented by SRI at two levels for obtaining wind and ΔT measurements. Similar meteorological instrumentation was installed by NOAA on an existing 91-m radio tower approximately 21 miles west of the tracer release point.

BEST COPY AVAILABLE

As shown in Figure 2, the R/V EKOS was operated by ANL approximately 7 to 10 miles offshore on Lake Michigan. At this distance offshore, the lake depth is approximately half of its maximum depth of 200 m. Near-surface winds, lake water temperatures, and kytoon-based wind and temperature profiles were obtained from this research boat. ANL also operated a Doppler acoustic wind sounder approximately two miles inland from the shoreline, where it documented the evolution of the internal boundary layer (IBL).

BEST COPY AVAILABLE



KEY:

- Tracer and Tetroon Release Point, Field Headquarters, and 72m Meteorological Tower (Base at 616 feet MSL)
- Aircraft Spiral Soundings
- Typical Aircraft Sampling Pass (Airborne LIDAR, Meteorological Aircraft)
- SODAR Units 1 and 2
- Doppler Acoustic Wind Sounder (DAWS)
- Tracking Radar for Balloon Wind Soundings
- Tetroon-Tracking Radar (Site still to be selected)
- Bag Samplers
- 10m Meteorological Towers
- Colocated Bag Samplers and 10m Meteorological Towers
- 91m Meteorological Tower (Base at 984 feet MSL)
- Boat (R/V Ekos) for Offshore Meteorological Measurements
- Typical Ground-Mobile LIDAR (Mark-6) Traverse

FIGURE 2 INSTRUMENTATION DEPLOYMENT PLAN FOR SEADEX-I

BEST COPY AVAILABLE

V SUMMARY OF TRACER TESTS CONDUCTED

Figure 3 presents the chronology of field activities conducted during SEADEX-I. After the instrumentation had been set up, checked out and calibrated, tracer tests were conducted each day, weather permitting, except for two days for crew rest.

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
23 May 1982 SHIPMENT AND SET-UP	24 SET-UP	25 SET-UP	26 SET-UP	27 CHECKOUT AND CALIBRATION	28 TEST NO. 1	29 TEST NO.2
30 TEST NO. 3	31 REST DAY	1 June WEATHER UNSUITABLE	2 TEST NO. 4	3 TEST NO. 5	4 TEST NO. 6	5 TEST NO. 7
6 TEST NO. 8	7 REST DAY	8 TEST NO. 9	9 CALIBRATION AND TAKEDOWN	10 CALIBRATION AND TAKEDOWN	11 TAKEDOWN AND SHIPMENT	12 TAKEDOWN AND SHIPMENT

FIGURE 3 SEADEX-I FIELD ACTIVITIES SCHEDULE

As indicated in Table 4, a total of nine tracer tests covering a total period of 50 hours were conducted during SEADEX-I. Since lake-breeze (on-shore flow) conditions were of primary interest in this study, all of the tests were conducted during daylight hours. For the most part, favorable lake-breeze conditions prevailed during the experimental period because of the relatively large land-water surface temperature differences (typically 10 to 15°C) that occurred during that period.

BEST COPY AVAILABLE

In general, all measurement systems operated satisfactorily during the field program, and a wealth of excellent data were obtained. For details about measurement results, reference should be made to Volumes 2 and 3 of this set, and to the reports prepared by the other investigators (NOAA, ANL and ARAP).

Table 4

SUMMARY OF TRACER RELEASES DURING SEADEX-I

Test No.	Date (1982)	SF_6 Release Start Time (CDT)	SF_6 Release Stop Time (CDT)	Release Duration (hrs)	Nominal Tracer Release Rate (lb/hr)
1	28 May	1300	1800	5	80
2	29 May	1300	1800	5	80
3	30 May	1200	1700	5	80
4	2 June	1100	1600	5	80
5	3 June	1000	1500	5	80
6	4 June	0900	1400	5	80
7	5 June	0800	1200	4	80
8	6 June	0800	1500	7	80
9	8 June	0900	1800	9	80
Total Hours of Tracer Data: 50					

BEST COPY AVAILABLE

VI LOGISTICS AND OPERATIONS

A. Logistics

All project personnel were housed at either St. Norbert College or Howard Johnson's Motor Lodge, which are located within one mile of each other in DePere, Wisconsin, approximately 5 miles S of Green Bay and 30 miles WNW of the planned Field Headquarters site. Having all of the project personnel in close proximity was an important operational advantage which facilitated project communications.

The NOAA sample analysis (GC) laboratory, as well as the project briefing room, was conveniently located at St. Norbert College (in Room 124 of Science Hall).

Both of the SRI research aircraft (Queen Air and Cessna 337) operated out of Austin-Straubel Field at Green Bay. This airport has major maintenance facilities and an instrument landing system (ILS). These advantages helped to minimize aircraft downtime related to mechanical or weather problems.

The ANL R/V EKOS docked at the Army Corps of Engineers facilities in the city of Kewaunee.

Three radio networks were used for communications between the stations indicated:

- SRI 122.75-MHz VHF ground-to-air system (HQ, Queen Air, Cessna 337)
- SRI 154.6-MHz VHF system (HQ, R/V EKOS, DAWS, oil fog release point, mobile vehicles)

BEST COPY AVAILABLE

- NOAA 169.075-MHz system (HQ, gas lab, sampler vehicles, radars, tetroon release point, gas release point).

Field Headquarters was established near the tracer release point at Kewaunee Power Plant. The SRI Mobile Environmental Laboratory (MEL), a 35-ft converted Greyhound bus, was used for this purpose. The MEL housed electronic systems for the meteorological instrumentation mounted on the 72-m tower, a computer-based data acquisition and display system, and all communications gear used by the Field Director in managing the field tests.

B. Operations

Typically, field operations were conducted daily according to the schedule below. Times are in hours relative to the start of tracer release.

Time	Activity
-3.0	Daily briefing by Field Director, attended by Task Leaders and key personnel
-1.0	Start bag samplers
-1.0	Start meteorological measurements
0.0	Start SF_6 and oil-fog releases
0.5	Start aircraft measurements
4.0	Stop oil-fog release
4.5	Stop aircraft measurements
5.0	Stop SF_6 release
8.0	Stop bag samplers
8.0	Stop meteorological measurements
8.0 to 14.0	Service bag samplers
14.0 to 38.0	Analyze bag samples (three shifts)

BEST COPY AVAILABLE

During the daily briefing, plans for the day were discussed, assignments were made, results from the previous test were presented, and the status of all instrumentation systems and measurement platforms were reviewed.

BEST COPY AVAILABLE

VII DATA REDUCTION, ANALYSIS, AND REPORTING

Each project participant was responsible for the reduction and reporting (and analysis, where appropriate) of all data which he/she collected during SEADEX-I. Data collected by ANL and Mesomet were furnished to NOAA/ARL for inclusion in the NOAA report.

The standardized specifications for all SEADEX-I digital data tapes are as follows:

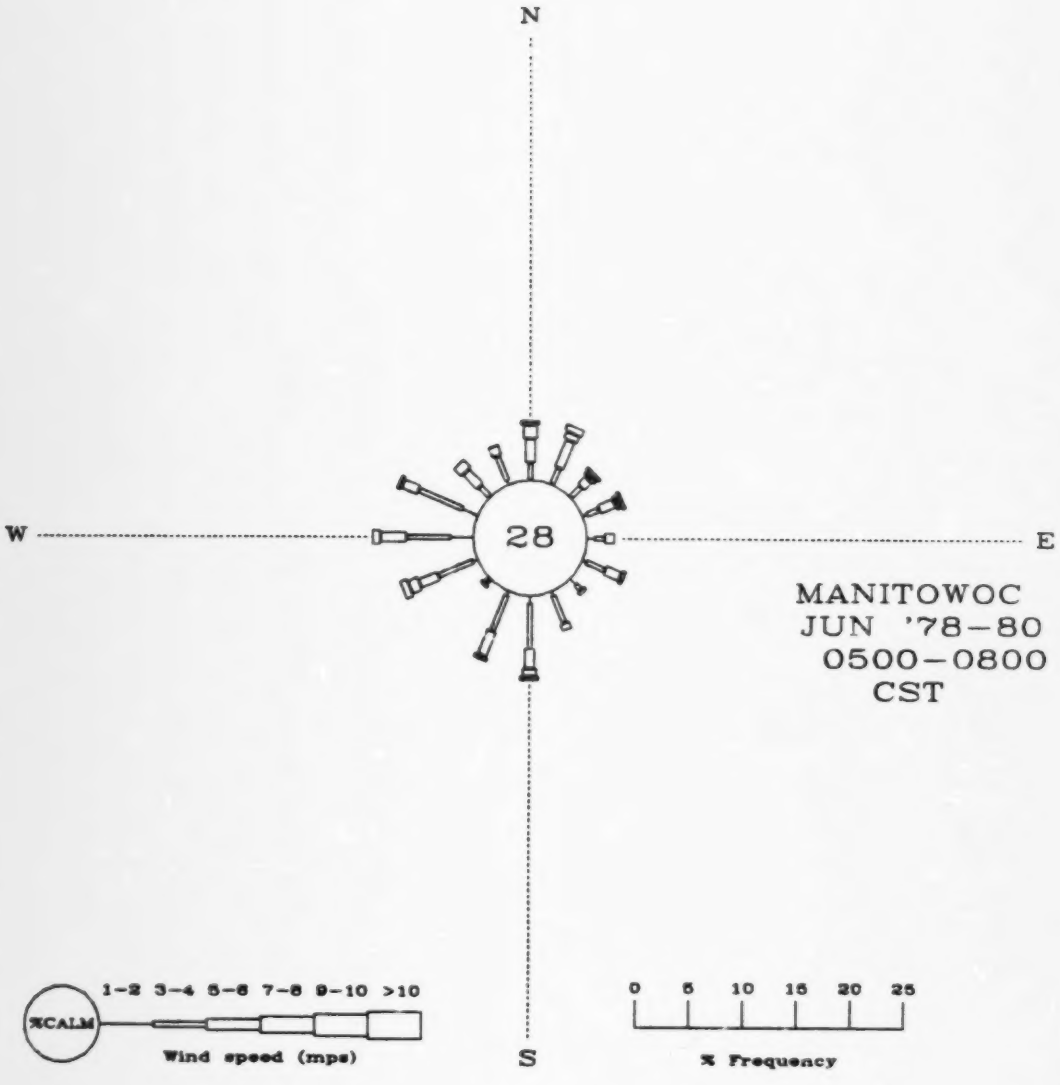
- Nine-track
- 1600 bits/inch
- Unlabelled (no file leaders)
- ASCII encoded.

BEST COPY AVAILABLE

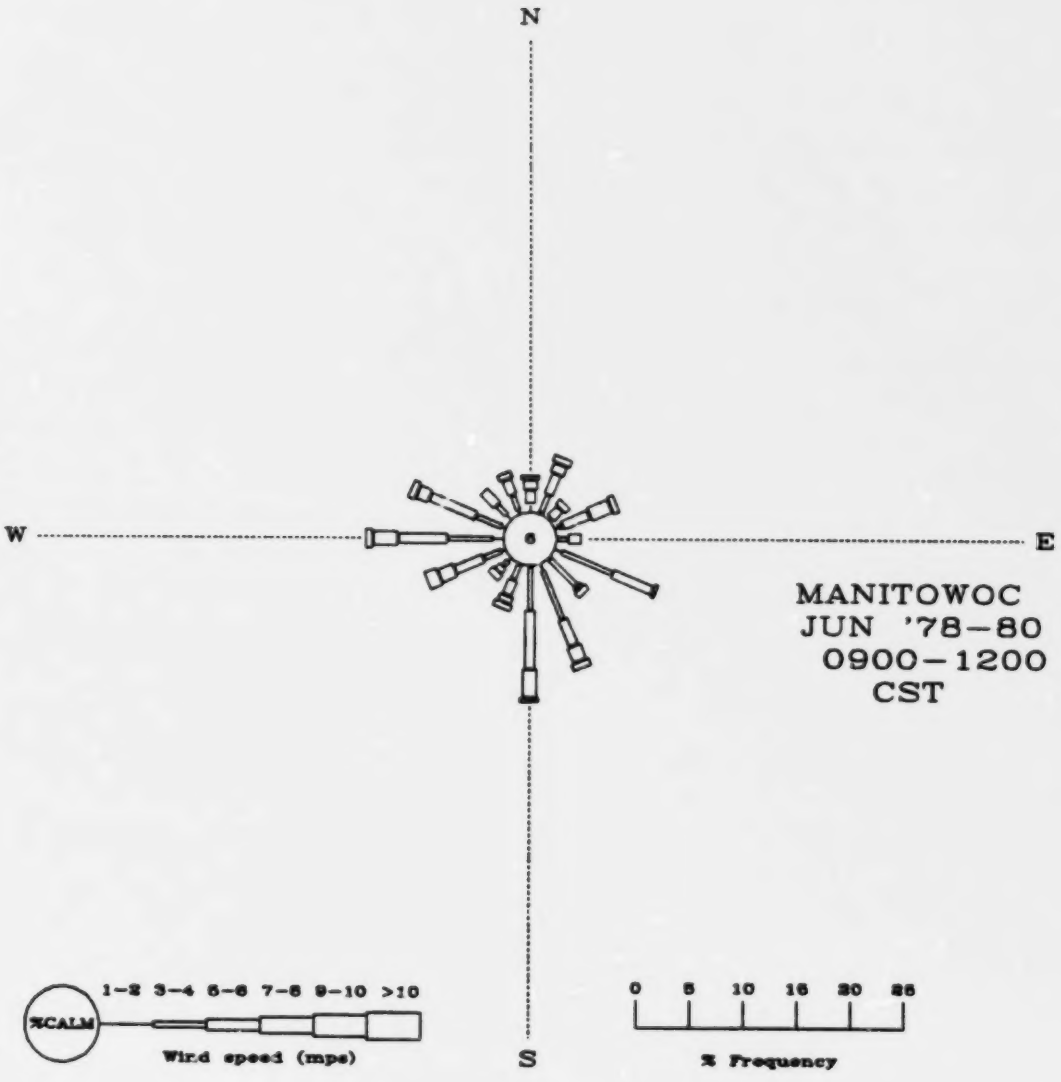
Appendix

WIND ROSES FOR MANITOWOC AND SHEBOYGAN, WISCONSIN
(June 1978-80)

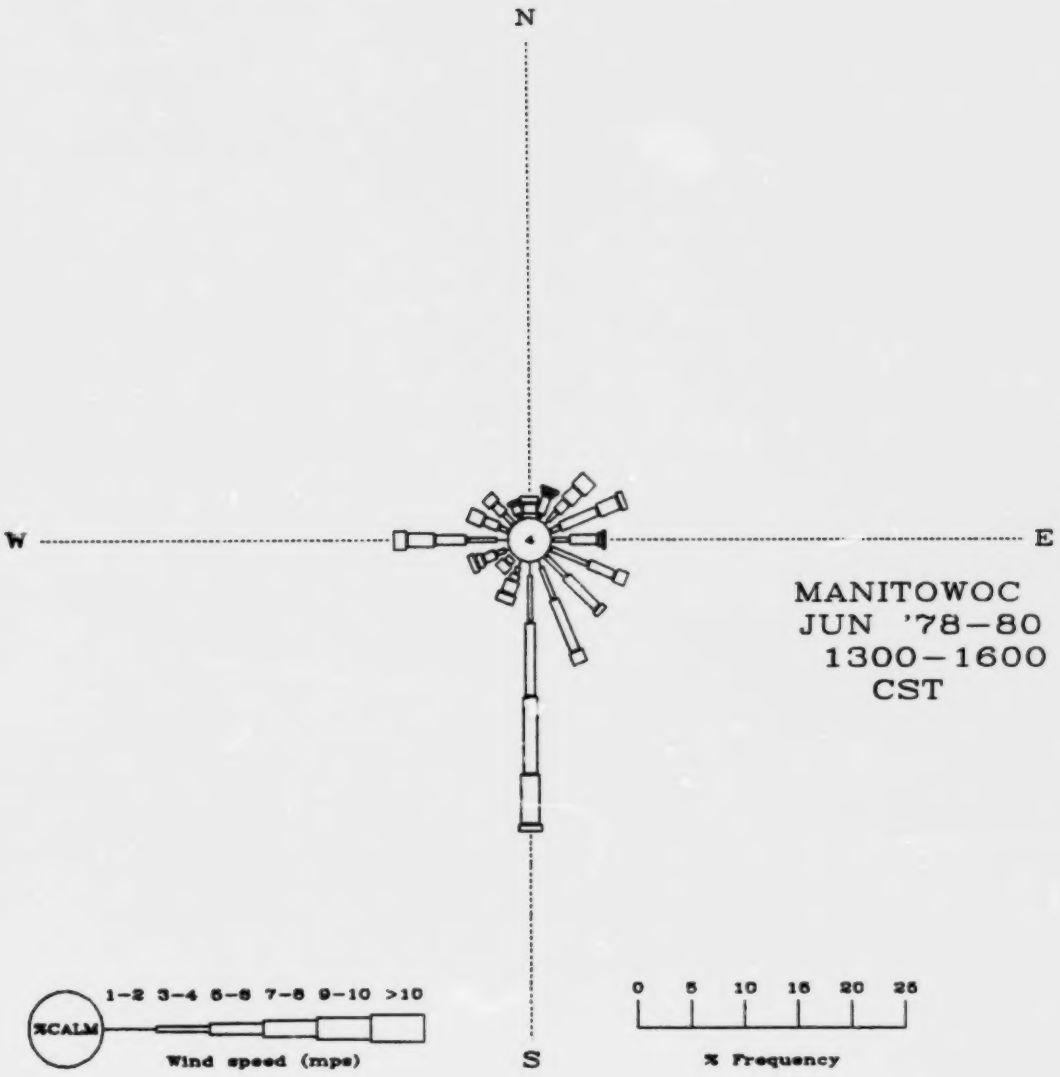
BEST COPY AVAILABLE



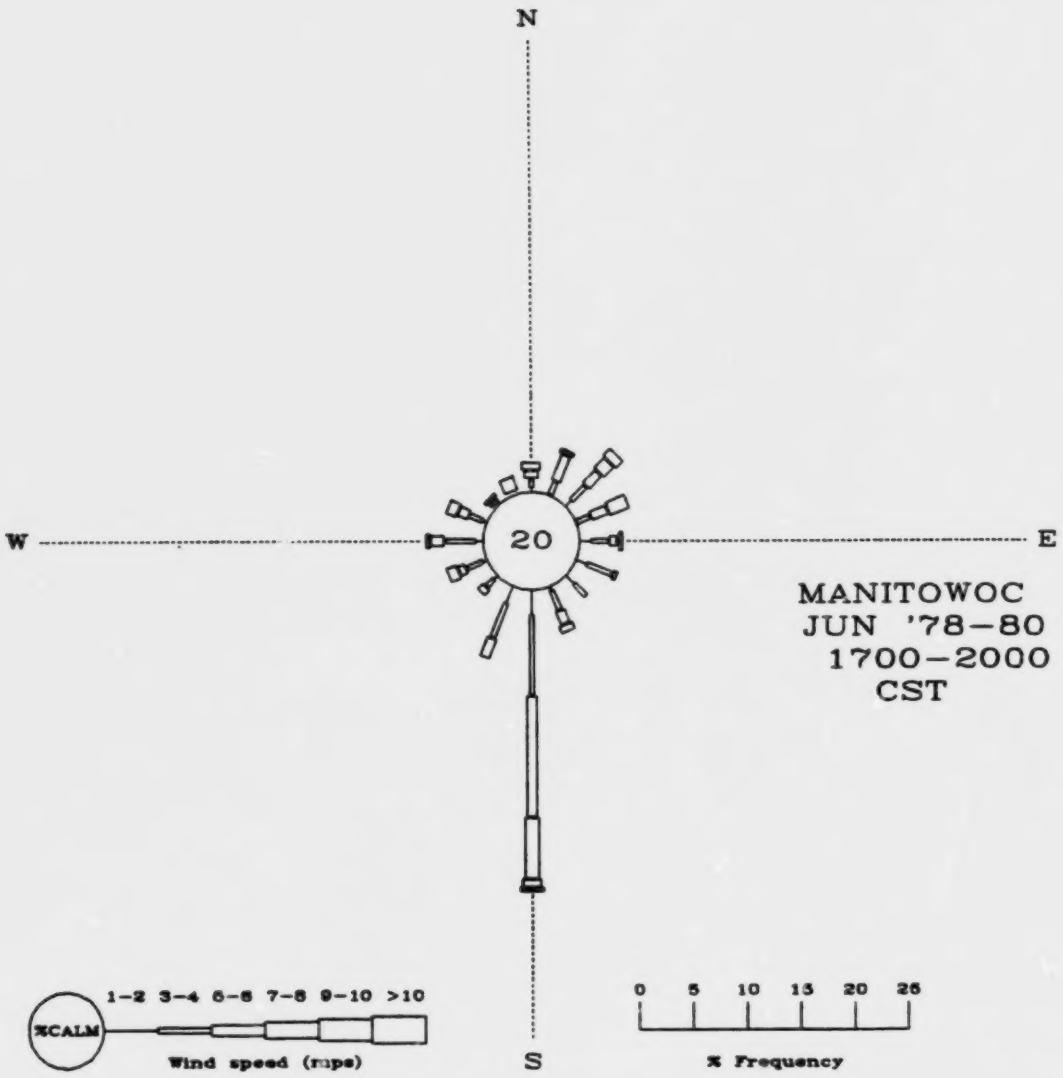
BEST COPY AVAILABLE



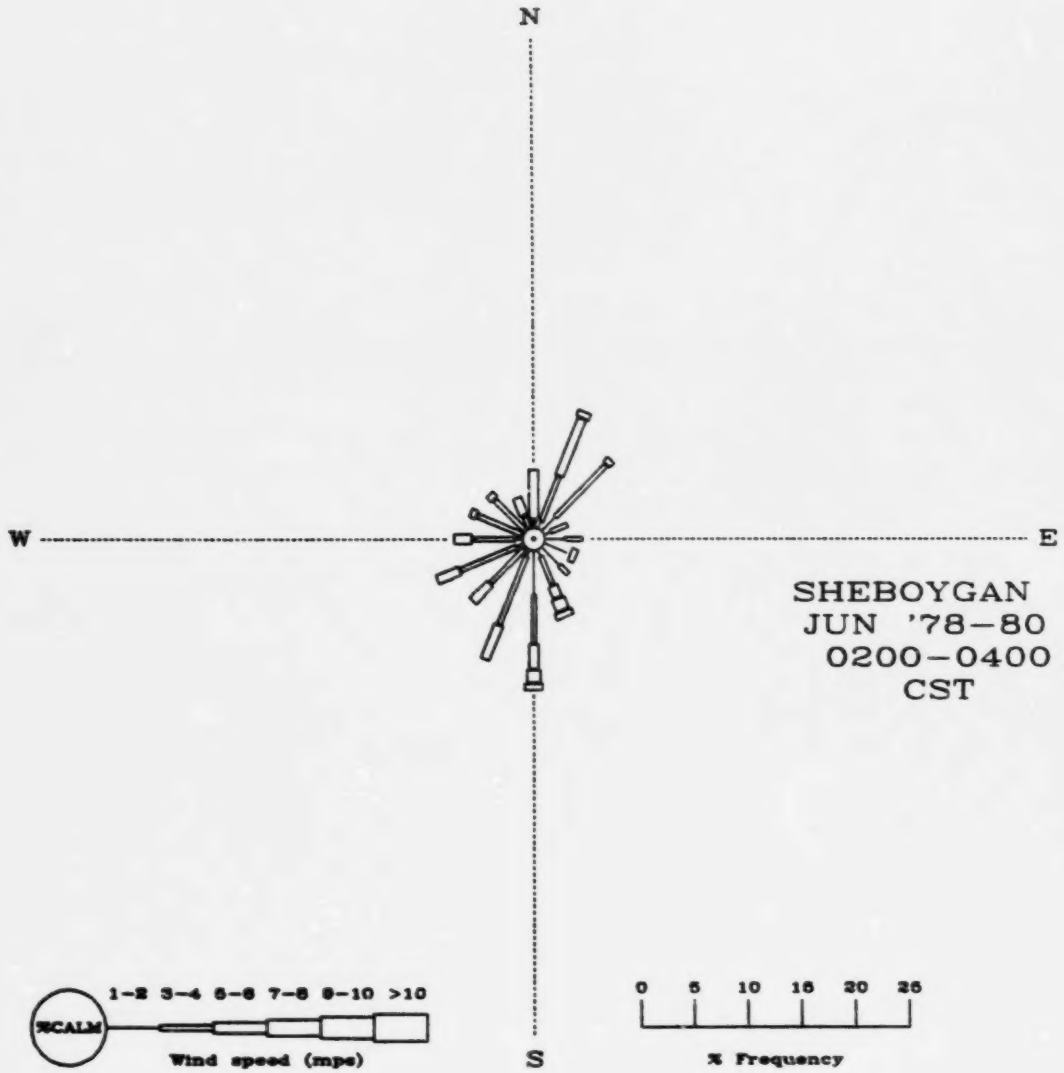
BEST COPY AVAILABLE



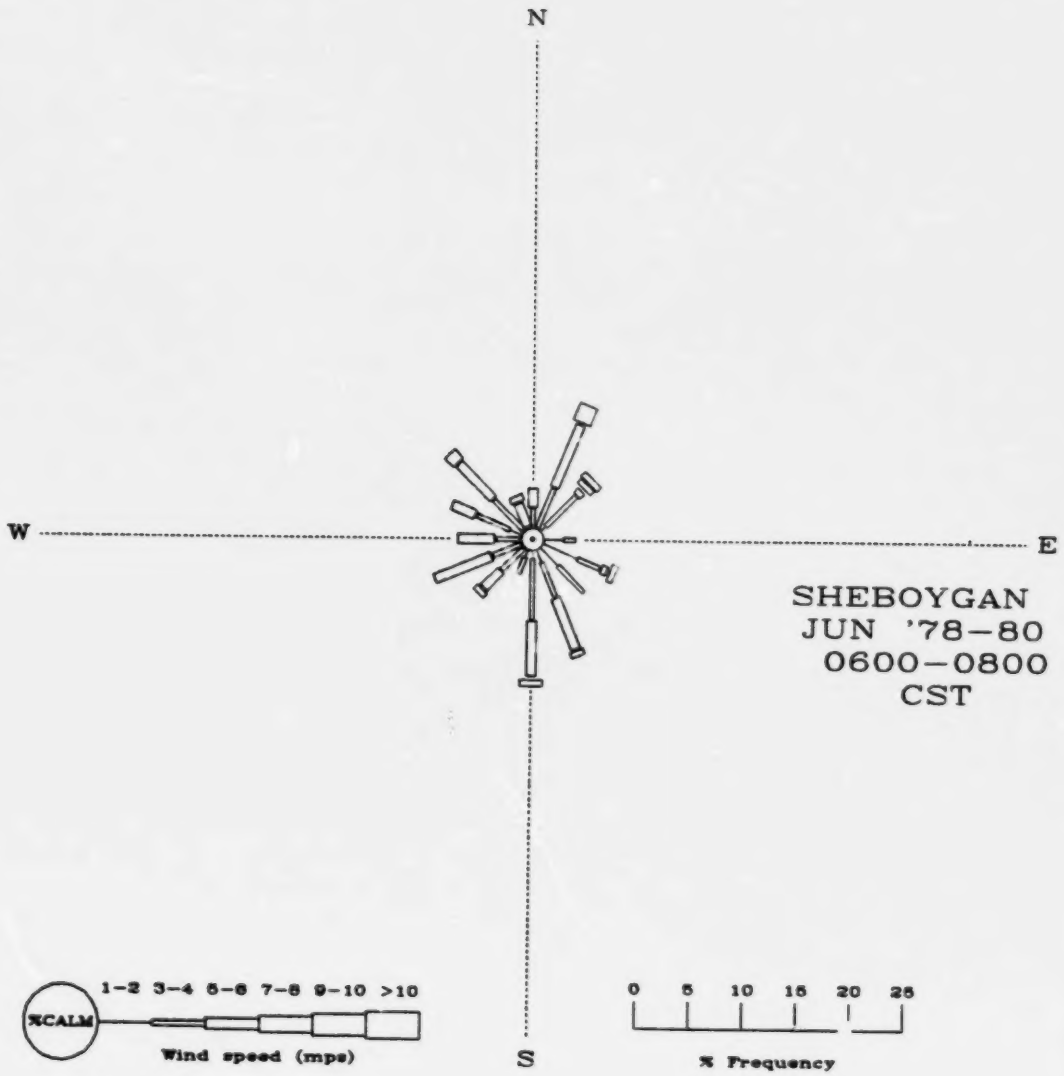
BEST COPY AVAILABLE



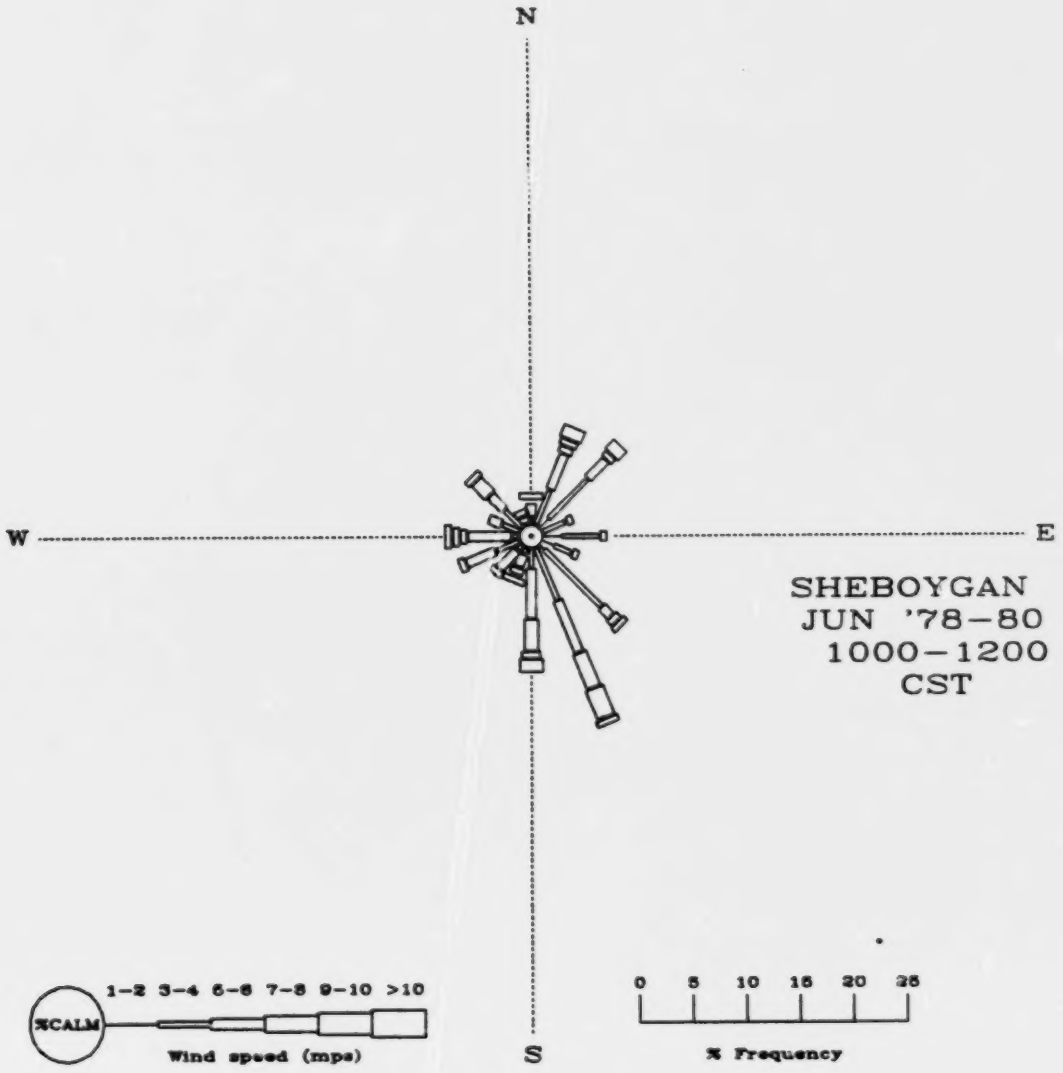
BEST COPY AVAILABLE



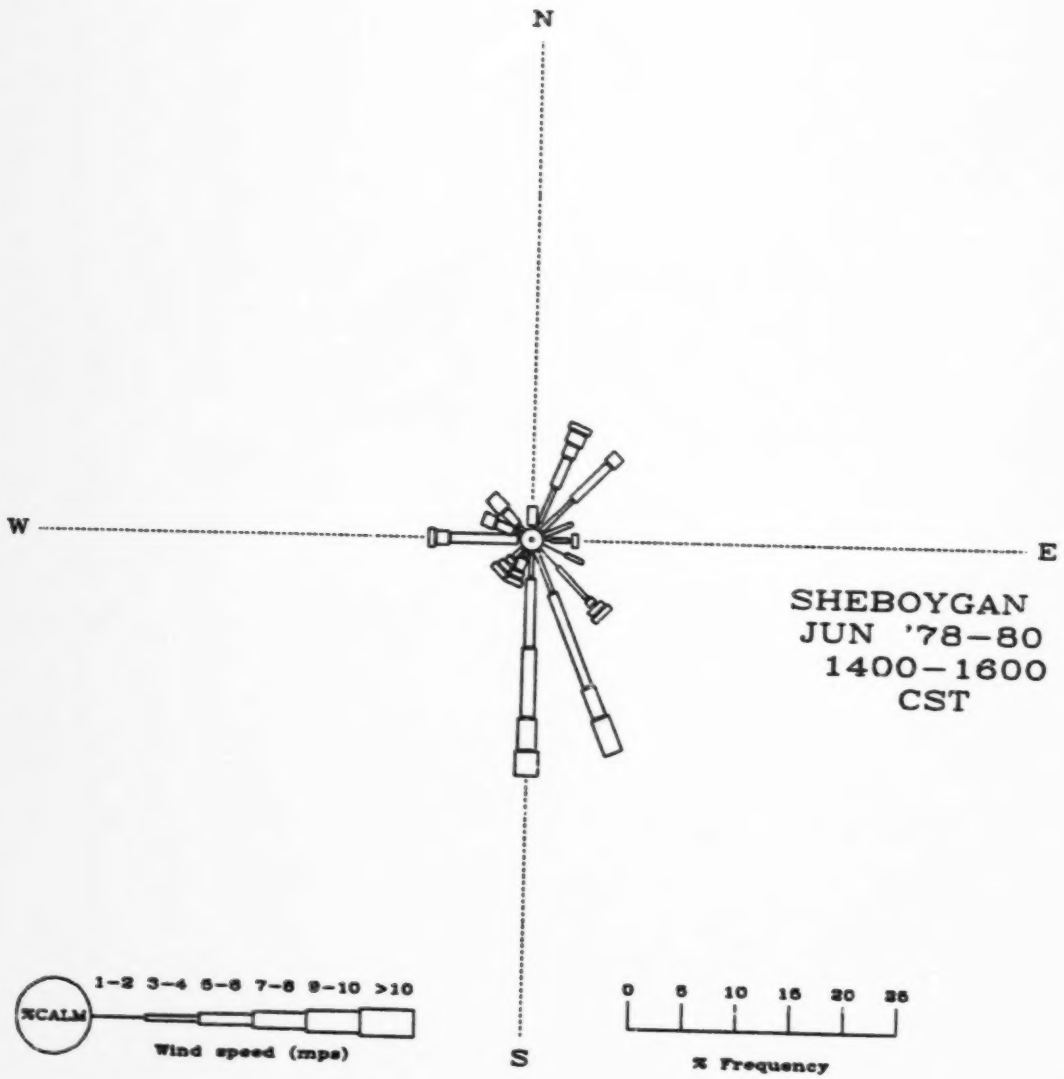
BEST COPY AVAILABLE



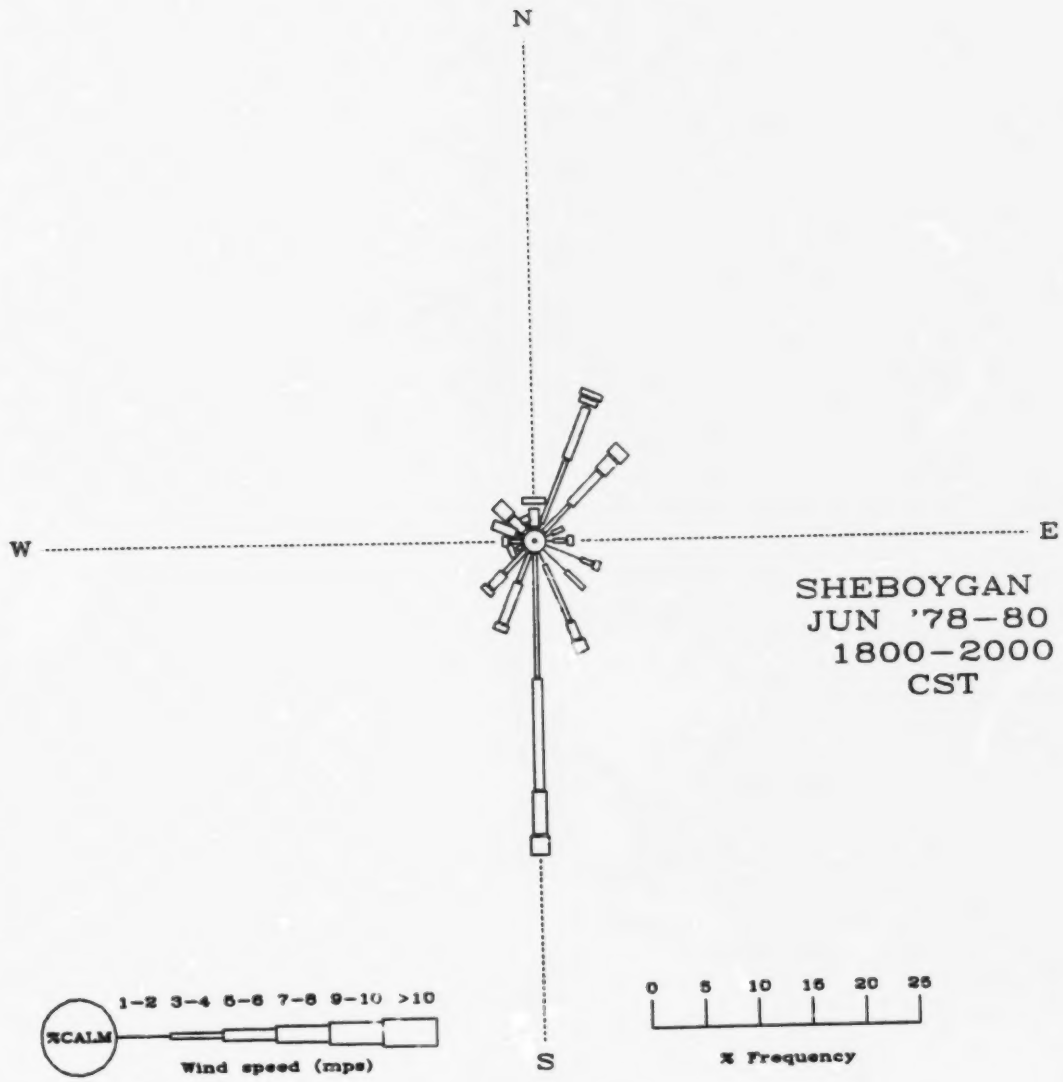
BEST COPY AVAILABLE



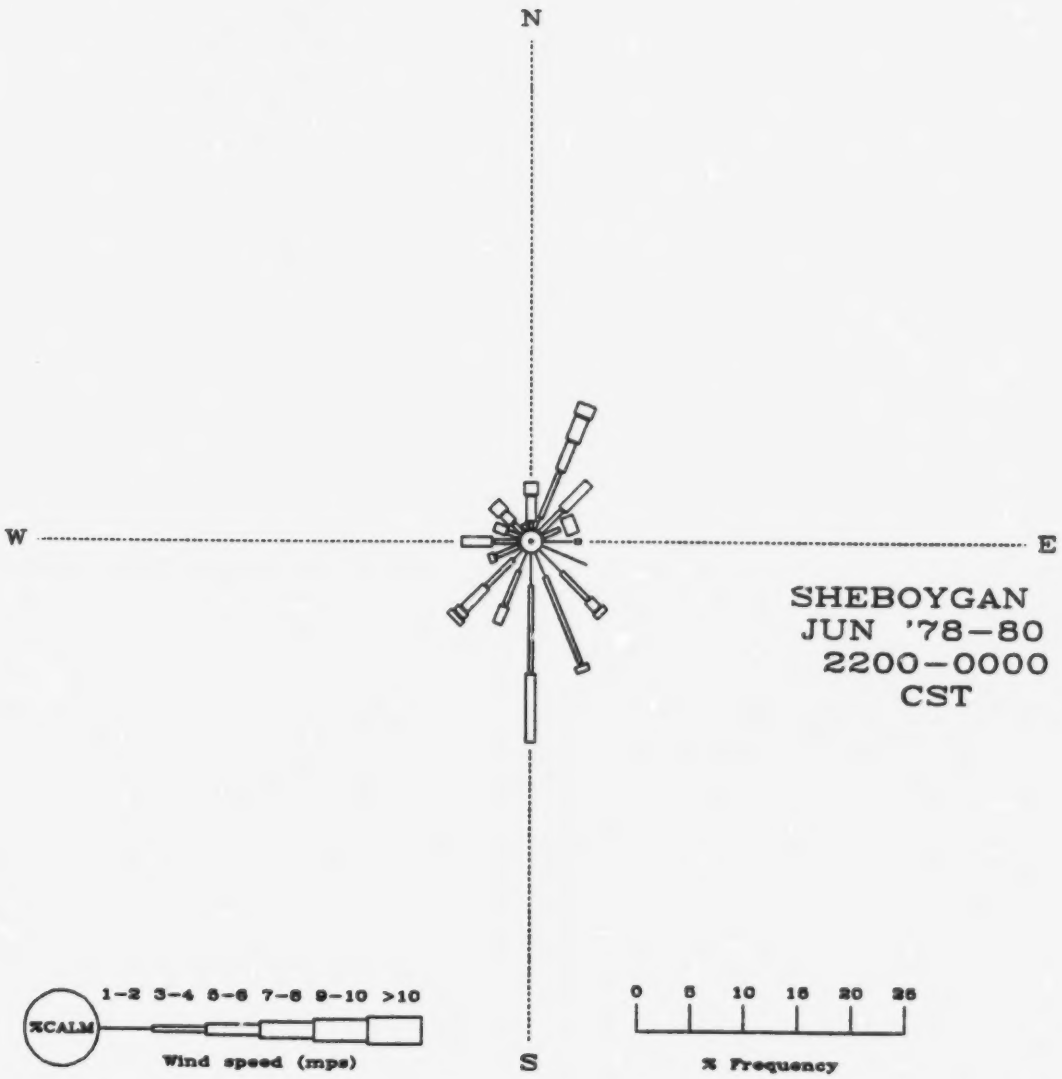
BEST COPY AVAILABLE



BEST COPY AVAILABLE



BEST COPY AVAILABLE



BEST COPY AVAILABLE

NRC FORM 335 (2-84) NRCM 1102, 3201, 3202

U.S. NUCLEAR REGULATORY COMMISSION

BIBLIOGRAPHIC DATA SHEET

SEE INSTRUCTIONS ON THE REVERSE

1. REPORT NUMBER (Assigned by TIDC, add Vol. No., if any)
NUREG/CR-4950
Vol. 1

2. TITLE AND SUBTITLE
The Shoreline Environment Atmospheric Dispersion Experiment (SEADEX)
Experiment Description

3. LEAVE BLANK

4. DATE REPORT COMPLETED
MONTH: March
YEAR: 1987

5. AUTHOR(S)
B.K. Cantrell, W.B. Johnson, B.M. Morley,
E.E. Uthe, K.C. Nitz

6. DATE REPORT ISSUED
MONTH: June
YEAR: 1987

7. PERFORMING ORGANIZATION NAME AND MAILING ADDRESS (Include Zip Code)
SRI International
333 Ravenswood Avenue
Menlo Park, CA 94025

8. PROJECT/TASK/WORK UNIT NUMBER

9. FIN OR GRANT NUMBER
B6793

10. SPONSORING ORGANIZATION NAME AND MAILING ADDRESS (Include Zip Code)
Division of Engineering
Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission
Washington, DC 20555

11a. TYPE OF REPORT
Technical

b. PERIOD COVERED (Inclusive dates)

12. SUPPLEMENTARY NOTES

13. ABSTRACT (200 words or less)

The SEADEX atmospheric dispersion field study was conducted during the period May-June 8, 1982, in northeastern Wisconsin, in the vicinity of the Kewaunee Power Plant on the western shore of Lake Michigan. The specific objectives of SEADEX were to characterize (1) the atmospheric dispersion and (2) the meteorological conditions influencing this dispersion as completely as possible during the test period. This field study included a series of controlled tracer tests utilizing state-of-the-art tracer measurement technology to determine horizontal and vertical dispersion over both land and water. Extensive meteorological measurements were obtained to thoroughly characterize the three-dimensional structure of the atmospheric boundry layer controlling the dispersion process. This volume describes the experimental design for, and conduct of, the study.

14. DOCUMENT ANALYSIS - a. KEYWORDS/DESCRIPTORS
airborne sampling
atmospheric dispersion
field study
gas tracer
LIDAR
meteorological measurements
plume trajectories
remote sensing
sampling network
shoreline environment

b. IDENTIFIERS/OPEN-ENDED TERMS

15. AVAILABILITY STATEMENT
Unlimited

16. SECURITY CLASSIFICATION
(This page) Unclassified
(This report) Unclassified

17. NUMBER OF PAGES

18. PRICE

*U.S. GOVERNMENT PRINTING OFFICE: 1987-181-682:60141

BEST COPY AVAILABLE